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TULAREMIC PNEUMONIA: TREATMENT WITH STREPTOMYCIN [1]

By R. L. PETERSON, *Designated Physician, United States Employees' Compensation Commission*, and R. R. PARKER, *Director, Rocky Mountain Laboratory, United States Public Health Service*

A case of tularemic pneumonia is described in which treatment with streptomycin was started immediately following diagnosis on the eleventh day of illness.

CASE REPORT

S. M. H., a 29-year-old white male employee of the Rocky Mountain Laboratory of the United States Public Health Service, became ill on the afternoon of February 23, 1946. The onset was sudden, beginning with a chill, followed by fever, sweating, and headache. Fever, malaise, sweating, and pain in back of the eyes persisted. Cough, together with pleuritic pain, appeared on the fourth day after onset. Sputum was scant. Physical signs were not numerous, consisting of a few scattered rales throughout the left lower lung field. The temperature ranged from 99.0° F. to 104.0° F. during this time and was spiked in character. There was no photophobia, no arthralgia, and no myalgia other than lumbar aching on the day of onset. There were no skin lesions.

On March 1, 1946, the patient was hospitalized. Chest X-ray showed diffuse infiltration of the lower lobe of the left lung. The white blood count was 9,600, with an essentially normal differential count. There was scant watery sputum, without hemoptysis. The urine contained albumin and granular casts. Fifty thousand units of penicillin were given intramuscularly, followed by 25,000 units every 3 hours.

The course remained febrile, the temperature reaching 104.2° F. or more daily. Roentgenogram of the chest on March 3 showed more extensive and dense infiltration in the left lower lobe. On March 6 dullness and diminished breath and voice sounds were noted posteriorly in the left lower chest. A roentgenogram on March 8 confirmed the diagnosis of atelectasis of the left lower lobe, with displacement of the heart and trachea to the left.

On March 6, the diagnosis of tularemic pneumonia was established by laboratory tests. Penicillin was discontinued and streptomycin hydrochloride was

[1] From the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

administered intramuscularly, 50,000 units every 3 hours for 18 doses. This exhausted the available supply.[2]

Three days later a supply of streptomycin sulfate (Abbott Laboratories) was received through the courtesy of Chester S. Keefer, chairman of the committee on chemotherapeutics, and other agents, of the National Research Council. On March 11, streptomycin therapy was resumed. The same dosage schedule previously employed was instituted and a total of one million units was administered.

The patient's response to streptomycin was dramatic. The drug was first administered at 4 p. m. on March 6; the patient's temperature was 104.4° F. at 10 p. m., but by 4 o'clock the next morning it was normal and remained so except for one rise to 99.0° F. on March 8. The pulse rate dropped from 90 and 100 to 60 and 70, and the respiratory rate likewise decreased. All subjective symptoms disappeared within 24 hours after the initial dose of streptomycin. Cough diminished, and a roentgenogram of the lung made on March 13 showed the atelectatic lobe to be reinflated. The patient was able to sit up March 12 and was discharged from the hospital March 15. He had lost 29 pounds during his illness.

The patient was able to return to work on April 1, 37 days after onset and 25 days after the initial dose of streptomycin. He gained weight rapidly. A chest film on March 22 still showed dense diffuse infiltration of the left lower lung, although there was no cough. Another film on April 26 showed resolution to be nearly complete.

LABORATORY TESTS

Blood samples taken on the third, ninth, eleventh, and twentieth days and a urine sample obtained on the sixth day after onset were injected into each of four guinea pigs. All animals remained well.

Sputum samples obtained on the sixth and eleventh days of illness were also tested in two groups of four guinea pigs each, two animals receiving the material intraperitoneally and two subcutaneously. Those receiving the first sample died in 3, 3*, 5*, and 5 days, respectively, and those receiving the second died in 3, 3, 6, and 6 days, respectively. All exhibited lesions typical or suggestive of tularemia. Portions of the two sputum samples were also injected intraperitoneally into two and four white mice, respectively. All died on the third or fourth days, their gross lesions being suggestive of tularemia. Pure cultures of *Pasteurella tularensis* were recovered from heart blood of the second and third guinea pigs of the first group. (Day of death marked with an asterisk.)

The Weil-Felix test, the agglutination test for tularemia, and complement-fixation tests for epidemic and endemic typhus, Rocky Mountain spotted fever, tsutsugamushi disease, and American Q fever were made with the four serum samples. The complement-fixation tests were negative. Proteus OX strains were not aggluti-

[2] The possible value of streptomycin for the treatment of tularemia had been suggested by preliminary tests made at the Rocky Mountain Laboratory in the spring of 1945 with infected guinea pigs. The streptomycin used was kindly furnished by Merck & Co. The experiments were terminated when the available supply of streptomycin was taken over in the early summer by the National Research Council. However, a million units, then on hand, were reserved against the possible occurrence of an infection in a member of the laboratory staff.

nated in significant titer. The test for tularemia was positive, the titers for the respective samples being as follows:

Day sample was taken	Agglutinin titers for *Pasteurella tularensis*					
	1:20	1:40	1:80	1:160	1:320	1:640
Third	–	–	–	–	–	–
Ninth	4+	4+	2+	–	–	–
Eleventh	4+	4+	2+	–	–	–
Twentieth	4+	4+	4+	4+	4+	2+

DISCUSSION

Foshay and Pasternack (*1*) have reported the successful treatment of seven cases of tularemia with streptomycin hydrochloride injected intramuscularly, treatment having been started on the third, eighth, seventeenth, twentieth, twenty-third, fiftieth, and one hundred and seventh day of illness, respectively. The dosage used in three of these cases was 30,000 units every 3 hours for 5 days (total per patient 1.2 million); in one case 30,000 units per dose for 5 days and 15,000 units for 2 more days (total 1.38 million); in one case 20,000 units per dose for 4 days (total 0.64 million); in one case 23,500 units per dose for 5 days (total 0.94 million); and in the last case, 50,000 units per dose for 2 days and 30,000 units per dose for four additional days (total 1.76 million). The last case was the one that was treated with streptomycin on the one hundred and seventh day of illness.

These authors report noteworthy relief of the distressing general symptoms before the end of the first day of treatment, and also report that this relief was striking by the end of the second day. The temperature became normal in one case by the end of the second day, in one on the third day, in one on the fifth day, in two on the sixth day, and in two others after a somewhat longer period. (Definite information is not given for one case, but the febrile period was obviously short.)

None of the cases reported by Foshay and Pasternack was tularemic pneumonia, hence, the case herein reported is of particular interest.[3] As previously stated, the response of this patient to streptomycin was dramatic. The temperature became normal within 12 hours after treatment was instituted, four doses having been given by that time. All distressing symptoms disappeared within 24 hours.

This patient received a total of 1.9 million units of streptomycin, 0.9 million units during the first course of treatment, and 1.0 million

[3] A case of tularemic pneumonia treated with streptomycin has been reported in a recent issue of the Journal of the American Medical Association (Cohen, R. B., and Lasser, R.: Primary tularemic pneumonia treated with streptomycin. J. Am. Med. Assoc., **131**: 1126–1127 (Aug. 3, 1946).). The patient, a Negro, received 7,062,000 units of streptomycin over a 10-day period, beginning about the thirty-seventh day of illness, at which time the patient was considered to be moribund. Administration was both intramuscular and intravenous. The result is described as dramatic. The patient was released from the hospital on the ninety-seventh day after onset.

during the second course. It is doubtful whether the latter series was necessary. The patient had been afebrile for 3 days when the second course was started; he was showing steady improvement, and the subsequent illness did not indicate that the additional streptomycin had been beneficial.

The evidence suggests that this patient became infected by the upper respiratory route and that the involvement of the lungs was primary.

SUMMARY

The dramatic response of a case of tularemic pneumonia to streptomycin is reported. Treatment with streptomycin was begun on the eleventh day. Doses of 50,000 units were given every 3 hours. The patient's temperature became normal within 12 hours and all distressing symptoms were relieved within 24 hours.

REFERENCE

(*1*) Foshay, Lee, and Pasternack, A. B.: Streptomycin treatment of tularemia. J. Am. Med. Assoc., **130**:393–398 (Feb. 16, 1946).

WINTER SURVIVAL OF *AEDES AEGYPTI* (L.) IN HOUSTON, TEX. [1]

By Stephen P. Hatchett, *Assistant Sanitarian (R), United States Public Health Service*

Introduction

Much has been written on *Aedes aegypti* (L.) in tropical zones, but comparatively little is known on variations of its life history in the somewhat colder regions. Rozeboom (*1*) has reported experiments on overwintering of eggs at Stillwater, Okla., and there are only a few other scattered data on the winter habits of this mosquito, particularly in areas where the weather during this period consists of warm days alternating with cold ones. This changeable winter weather is typical of Houston, Tex., where there are usually several periods of freezing weather and also days when the mean temperature is above 70° F. If not controlled, *Aedes aegypti* would be abundant in Houston. Therefore, the present investigation was inaugurated to ascertain the winter habits of this vector of dengue fever, so that this knowledge might be applied, if necessary, to future control procedures.

A similar study was made during the winter of 1943–44, but unfortunately it was begun rather late in the season. The present investigation was started during the middle of November 1944, prior to the onset of cold weather, and it was continued until April 1945. The winter of 1944–45 was extremely mild, inasmuch as there was but one day (December 11) of freezing weather; this condition lasted only 5 hours,

[1] From Malaria Control in War Areas, States Relations Division.

and the minimum temperature did not fall below 30° F. This is in contrast to the winter of 1943–44 when freezing weather occurred on five different occasions. During most of March and on 18 other days during the winter of 1944–45 the maximum temperature was 70° F. or above. Official United States Weather Bureau temperature records were used as well as readings from a maximum-minimum thermometer located in one of the experimental areas. Water temperatures were taken daily from representative containers. Approximately 15 inches of rain fell during these 4 months, which is about normal for this period.

From the onset of the study until the middle of February there was a gradual increase in the number of eggs under observation, so that during the course of the investigation approximately 10,000 eggs, procured from laboratory-reared females, had been placed under various conditions. The majority of eggs were deposited on the sides of experimental containers or on the water surface. The other eggs were laid on filter paper. The containers were placed outdoors between 36 and 72 hours after deposition of eggs, and the eggs then were treated as described below. For some groups of eggs this was an adequate incubation period, but it may not have been long enough for others. The great variation in the number of eggs that hatched per container may have been caused, in part, by the length of time eggs were left undisturbed after being laid. Observations were made on the larvae that hatched from the eggs and also on several thousand others found living in tires and other water-holding containers in two junk yards.

Effect of Winter Temperatures on Eggs

Viability

Eggs were placed in various types of containers under different environmental conditions, and given various treatments. In one group of containers the eggs were kept immersed throughout the winter. In another, the containers, with *Aedes aegypti* eggs attached to their inner sufaces, were filled with rain water so that the eggs were just above the water surface. Subsequent rains covered the eggs with water, which was never replenished except by normal rainfall. In this manner eggs were repeatedly immersed, but were dry during intervening periods. In a third group of containers the eggs, in accordance with Johnson's (*2*) statement that eggs dried soon after deposition do not hatch, were allowed to incubate about 72 hours and afterwards were kept continuously dry from the time they were set out until March 3, 1945. On this date, eggs in all groups, not already immersed, were immersed in rain water and kept under observation for hatching of larvae until April 3.

Approximately half of the containers in each group were placed in partially protected places in open sheds, under grass, etc., while the other half were placed in fully exposed situations.

The hatch of eggs kept continuously wet (43.5 percent) was considerably higher than that of the eggs intermittently dried or dried for one continuous period (28.4 percent and 21.4 percent, respectively) (table 1). As can be seen from table 1 there is a great variation in the number of eggs that hatched in individual containers in all three groups. However, the hatch in 14 of the 18 containers with continuously wet eggs fell between 16.5 percent and 67.4 percent (average 39.5 percent), whereas in 25 of the 28 containers dried intermittently or continuously before final immersion of eggs, the hatch fell between 5 percent and 53 percent (average 21.9 percent). If all containers are considered there is still a significant difference between the percentage of larvae hatched from eggs continuously wet and those dried for any length of time.

TABLE 1.—*Viability of eggs exposed to winter temperatures*

Treatment of eggs	Number of containers	Total number of eggs	Range of percent hatched	Total percent hatched
Continuously wet:				
Fully exposed	10	1,650	1–95	35.2
Partially protected	8	1,565	16.5–75.6	52.3
Total	18	3,215	1–95	43.5
Intermittently wetted by rain:				
Fully exposed	7	1,050	5–53	24.8
Partially protected	8	1,000	9–65	31.2
Total	15	2,050	5–65	28.4
Dried 22–109 days:				
Fully exposed	7	1,017	6.6–78.5	17.7
Partially protected	6	1,063	11.3–69.8	25.0
Total	13	2,080	6.6–78.5	21.4
Grand total	46	7,395	.....	32.7

The length of the drying period did not appear to influence the viability of eggs if they were dried at all, for more eggs hatched from the container dried for the longest time (109 days) than from any other; on the other hand the fewest eggs to hatch in any container were in a container dried for 102 days. Le Van (*3*) found that *Aedes aegypti* eggs dried for a year still hatched, and Bacot (*4*) reported some eggs hatched after drying for 15 months.

In all three groups the hatch is lower in the fully exposed containers than in the partially protected ones (table 1). The average hatch in all the fully exposed containers considered together was 29.5 percent, whereas in the partially protected containers it was 38.5 percent. The combined effect of continuous immersion and partial protection as compared with intermittent or continuous drying and full exposure increased the average hatch per container from 25.5 percent to 50 percent. Regardless of treatment, the size and type of container appear to have had little influence on the viability of eggs during

the winter of 1944–45. The volume of water in a receptacle probably would have had more influence if there had been longer or more severe spells of cold weather.

In addition to observations on the above-mentioned containers, observations were also made on eggs deposited under natural conditions in barrels, tires, and other large receptacles. However, it was not possible to ascertain even the approximate number of eggs on the sides of these containers, and nothing was known about the time of their deposition. Therefore, they have not been considered in the above data, but the results were similar.

Since there was only one short period of freezing weather during the winter of 1944–45, a series of experiments was performed on the effects of artificial cold on *Aedes aegypti* eggs. These eggs were 48 to 72 hours old at the onset of the experiments and were all laid within a 24-hour period by females in one rearing cage. The results obtained are shown in table 2. Temperatures higher than 34° F. were not

TABLE 2.—*Effect of artificial cold on eggs of* Aedes aegypti (*L.*)

Container No.	Treatment			Number eggs hatching at intervals after exposure						
	Hours dry	Exposed to cold	Hours cold	24 hours	48 hours	96 hours	144 hours	192 hours	250 hours	Total number
1 [1]	48	[2] 34	24	0	0	4	16	1	21	42
2	48	26	24	0	1	4	1	4	0	10
3	48	26	48	0	0	0	0	0	0	0
4	48	Room temperature as control		0	3	15	26	18	11	73
5	0	34	24	7	8	2	1	11	26	55
6	0	26	24	0	0	0	0	0	0	0
7	0	26	48	0	0	0	0	0	0	0
8	0	Room temperature as control		16	13	48	3	6	0	86

[1] 100 eggs per container.
[2] Degrees Fahrenheit.

effective deterrents on the subsequent hatching of eggs, and therefore are not included in the table. All eggs in these experiments, except the controls, were subjected to artificial cold in an electric refrigerator for varying periods and temperatures, after which they were returned to room temperature for further observation. No eggs hatched while in the refrigerator. Half of these eggs were dried for 48 hours and were then immersed in rain water just prior to exposure. The other eggs were kept continuously wet. Exposure to 34° F. for 24 hours reduced the number that hatched by about 40 percent in both groups. In both the controls kept at room temperature and those exposed to 34° F. the eggs previously dried were slower in hatching than the eggs kept continuously wet. Exposure to 26° F. for 24 hours reduced the hatch of the previously dried eggs to 10 percent, while none of the continuously wet eggs survived this exposure. No eggs in either group hatched after exposure to 26° F. for 48 hours.

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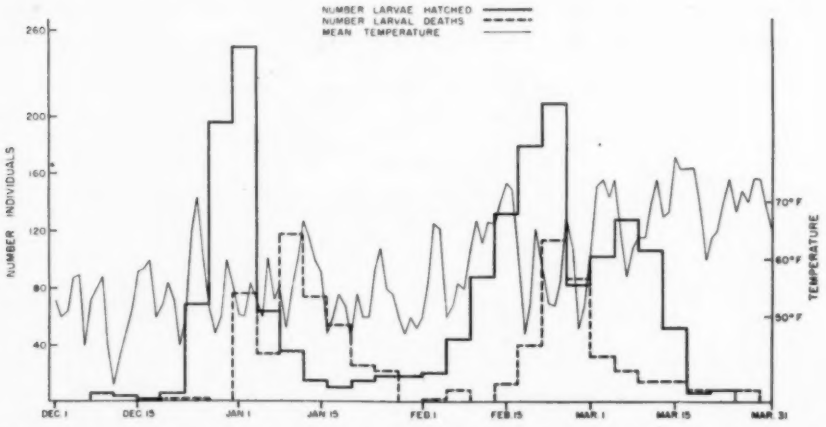
This is in agreement with early experiments of Bacot (*5*), but Davis (*6*) reports that a few eggs hatch after a 48-hour exposure to −5.5° C. (22° F.).

Time of Hatching

Although some eggs hatched nearly every day from December 7 through March 15 (fig. 1), the number hatching at any one time was markedly influenced by the temperature. There were only three periods (December 25–27, February 12–15, March 1–4) during the winter when the mean temperature was 70° F. or above, and immediately following these periods there was an acceleration in the hatching of eggs. Although the mean temperature during the first 2 weeks of February did not reach 70° F. until the 12th, there was a gradual rise in the temperature during this period, and along with



TEMPERATURE IN RELATION TO BIRTH AND DEATH OF *AEDES AEGYPTI* LARVAE - WINTER OF 1944-45

FIGURE 1.

this rise there was a corresponding increase in the number of eggs that hatched. However, this particular spurt in hatching of eggs reached its maximum after the mean temperature was above 70° F. Few eggs hatched when the mean temperature dropped below 50° F. During most of January the mean temperature fluctuated a great deal from day to day, but seldom averaged as high as 60° F. As a result of this, few eggs hatched during this month. Although the mean temperature did not drop below 60° F. after the first week in March, few eggs hatched. This was because most of the viable eggs had already hatched.

In spite of the mild weather prevailing during the winter of 1944–45, the temperature was low enough to retard the hatching of eggs to a considerable degree. Under optimum conditions, the majority of newly laid *Aedes aegypti* eggs hatch within a week after immersion. In contrast to this, during this particular winter only a few eggs hatched after being immersed a week, although early in the winter some eggs

hatched after 48 hours of immersion (table 3). On the other hand, some eggs were continuously immersed for as long as 64 days before the first larva appeared, and in several batches over 90 days of immersion elapsed before the last eggs hatched. It is possible that if these observations had continued beyond the first week of April even longer prehatching periods would have been observed. In general, the majority of eggs in an individual set hatched within a short interval of each other. However, in most batches one or two eggs hatched

TABLE 3.—*Days* Aedes aegypti *eggs were immersed before hatching, winter 1944–45*

Treatment of eggs	Immersion dates	Number of containers	Days immersed before hatching					
			Maximum range	Maximum average	Mean range	Mean average	Minimum range	Minimum average
Continuously wet	*1944* Nov. 27–Dec. 30	6	69–92	80	12–73	40	2–64	20
	1945 Jan. 8–Jan. 22	6	36–48	43	29–36	31	20–30	25
	Feb. 9–Feb. 22	6	21–41	30	10–23	16	3–18	10
Dried 1–16 days	*1944* Dec. 1–Dec. 30	3	20–93	57	18–68	43	15–60	38
	1945 Jan. 8–Jan. 18	5	41–57	50	25–50	36	15–48	31
	Feb. 9–Feb. 22	5	22–70	36	14–28	19	5–12	7
Dried 30–109 days	*1944–45* Nov. 27–Feb. 22	7	20–95	81	26–54	40	13–46	33
All containers	Nov. 27–Feb. 22	38	20–95	52	10–73	28	2–64	19

earlier than the others. It appears from the data in table 3 that most of the delayed hatching occurred in groups of eggs that were immersed most of the winter, whereas eggs that were immersed in February, after the weather had become milder, hatched more quickly. There is a definite gradation with advancing dates of immersion in maximum as well as average and minimum prehatching immersion periods. This is apparent for wet eggs as well as eggs dried for as long as 16 days.

Effect of Winter Temperatures on Larvae and Pupae

In the previous section it was shown that the temperature had a definite influence on the hatching of *Aedes aegypti* eggs. A similar relationship, although not as apparent, was found between the mean temperature and time a larva took to complete its development, pupate, and then emerge as an adult. This correlation has been ascertained by others under experimental controlled conditions; e. g., Shannon and Putman (*7*), Headlee (*8*), (*9*), (*10*), Chandler (*11*), and others. In nature, however, the temperature fluctuates a great deal and in a manner difficult to duplicate experimentally, so the observations of Headlee (*9*) and others were repeated but under natural outdoor conditions as they existed in Houston during the winter of 1944–45.

There is a wide range in periods of time necessary for different batches of larvae to complete their development, even under rather similar temperature conditions. Of 34 batches on which data are available, the minimum period for development ranged from 7 to 24 days except in one instance in which it was 40. This was the only case in which the mean temperature for the period was below 60° F. (58° F.). However, at 69° F. the minimum period varied from 10 to 23 days. The maximum period for development varied from 15 to 59 days. In six instances for which the temperature for the maximum periods fell below 58° F., this period was from 39 to 59 days. On the other hand in nine instances in which the mean temperature for the maximum periods was 65° F. or above, this period was from 15 to 28 days.

Headlee (*10*) found that when the temperature remained constantly lower than 60° F. larvae were not able to complete their development, but if it varied from 55° F. to 65° F., 15 percent of the larvae would become adults within 55 days. The results in the field experiments quoted above are not entirely in conformity with Headlee's laboratory observations, since in two different instances adults were produced at mean temperatures as low as 53° F. The actual average temperature for the periods in question may, of course, have been higher than the recorded mean temperature, since the latter is only a mean of the maximum and minimum for each day. The presence of abundant food (yeast) in the above cases may have been one of the determining factors in survival under these conditions. Approximately 42 percent of these slow-maturing larvae mentioned above became adults, but only 2 of the 43 specimens were females, and these died 4 days after emergence, never having fed on blood. The adults from larvae that took over 30 days to complete their development seldom fed on blood, and usually died shortly after emerging. Several of these slow-maturing larvae were not able to emerge from the pupal cases and died in the attempt. Usually less than 50 percent of the slow-maturing larvae ever became adults. More adults were obtained from batches of larvae in which the range in time taken to complete development was small.

There were two periods in the course of their development when larvae were particularly susceptible to unfavorable conditions. One of these was from the time larvae leave the egg until they undergo the first molt. This may be seen in figure 1, where the curve on larval deaths lags less than a week behind the curve depicting the number of larvae that have hatched within a 4-day interval. A second period of high mortality was during the final molt, after which the individual became a pupa. However, not as many specimens died at this time as during the first instar. Temperatures below 50° F. were particularly hard on larvae in these two developmental stages. Larvae in

other phases of development were better able to survive the cold. In all instances, however, the amount of detritus on the bottom of the container materially aided in the survival of all individuals in all developmental stages when a cold spell came.

Under the winter conditions of 1944–45 the temperature had little effect on duration of the pupal stage. In general, pupae appeared 2 to 3 weeks after the eggs hatched. Frequently during the last week of January and the first week of February the minimum temperatures at night would suddenly fall below 50° F., but the days were warm. It was during this period that many individuals were pupating during the warm afternoons, or emerging as adults. Sudden changes in temperature at this time resulted in the death of many specimens in these molting groups. The adults were caught when only partially out of the pupa cases. The above-mentioned 2-week period, however, was the only time when pupae were killed in significant numbers.

Effect of Winter Temperatures on Emergence of Adults

The number of adults that emerged at any one time depended on the patterns set by the hatching of larvae. The majority of adults usually appeared 2 to 4 weeks later. The first adult (a male) emerged on the afternoon of January 26, but died 2 days later. The great majority of adults that emerged up to the middle of February did not live very long. However, a very few females did take blood meals and subsequently laid eggs. On the other hand, most of the adults that emerged after the middle of February were able to survive the cold nights (minimum 43° F.). A majority of these females fed on blood and laid eggs. These adults were in screened cages (36″ x 18″ x 18″) placed on the south side of a small shed on the ground. Several gallon paint cans were laid on their sides in the cages to afford shelter and protection.

In February it was possible to ascertain the sex of emerging adults since each jar was screened. The ratio of males to females from late January through February was approximately three to one. During March, containers with pupae in them were placed in cages so that adults from these receptacles became mixed, and newly emerged adults could not be easily separated from the older ones.

From the 1,883 larvae that were under very close observation throughout the winter, 985 (52 percent) became adults. The shift in the entire *Aedes aegypti* population from egg to larva to pupa to adult is illustrated in figure 2. Living larvae and living pupae are shown only for a specific time interval. However, dead larvae and pupae are shown cumulatively so that all individuals that hatched were accounted for on April 3, when the last adult emerged. During the middle of January many larvae died, so that only 17 percent of individuals hatching prior to February 15 became adults. Shortly after the first of March the weather warmed noticeably and after this few

deaths of immature individuals occurred. In considering the entire period from February 15 to April 1, 56 percent of the immature population became adults. After the middle of March few eggs hatched, so that by the first week in April all members of this population had either died or become adults and none were larvae or pupae.

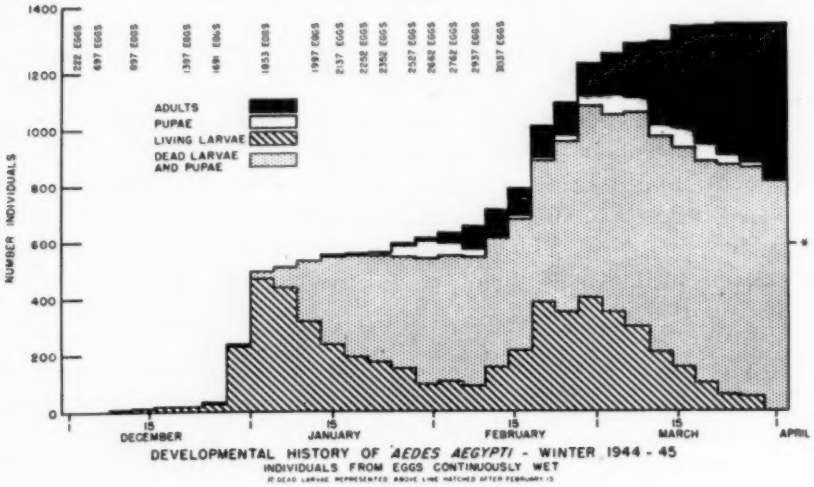


FIGURE 2.

Discussion and Summary

Houston usually has several periods of freezing weather. However, as previously mentioned, the winter of 1944–45 was rather atypical in this respect, and the results obtained from this investigation should be interpreted with this in mind.

Specific conclusions are difficult to make, since there were a great many variations in different containers, and the reasons for these are not completely known. The present investigation corroborates some of the data obtained during the previous winter and in other instances extends information obtained that season.

From the data obtained during the course of this investigation in Houston the following conclusions may be made.

1. Over 40 percent of the eggs hatched that had been continuously wet all season. In contrast to this, during the 1943–44 season when winter conditions were more severe, approximately 25 percent of the continuously wet eggs hatched.

2. During both seasons less than 30 percent of the eggs hatched that remained dry until winter conditions no longer existed and were then immersed. Approximately the same percentage applies to eggs intermittently dried between rains. Eggs stored in partially protected places, whether wet or dried, tended to produce somewhat larger hatches than those left in fully exposed situations.

3. Many eggs hatched when the mean temperature was 70° F. or over. However, there were some eggs hatching throughout the entire winter, although very few hatched when the mean temperature was below 50° F. In the 1943–44 season no eggs hatched when the mean temperature fell below 45° F.

4. A few eggs hatched approximately 48 hours after they were placed outdoors. These eggs were probably over 18 hours old when removed from the indoor cage where they were deposited. On the other hand, some eggs did not hatch until 90 to 95 days of immersion had elapsed.

5. The mean period of immersion before hatching was about 32 days.

6. Eggs that had been continuously wet since time of deposition did not survive artificial cold of 26° F. when it lasted 24 hours or longer. However, 10 percent of the eggs hatched that previously had been dry and were then immersed in cold water and frozen at this temperature for 24 hours. Approximately half of all eggs hatched that were previously exposed to artificial cold of 34° F. for 24 hours.

7. During both winters, larvae were better able to survive cold weather when there was a layer of organic matter on the bottom of the container.

8. Larvae that have just emerged from eggs, and old larvae preparing to pupate, are more susceptible to sudden chilling than others.

9. During the entire season approximately half of the larvae under observation became adults. But previous to February 15, less than 20 percent of them became adults.

10. The period from hatching to emergence of adults ranged from 7 to 59 days. Most specimens took 2 to 3 weeks to complete their development and emerge as adults.

11. The death rate of slowly maturing larvae was high. Most adults whose immature development was slow were weak, and many died within 2 to 3 days after emergence.

12. The mean pupal period during this winter was 4 days. No individual lived that remained as a pupa for more than 10 days.

13. Most females that emerged after the middle of February lived at least long enough to mate, feed on blood, and oviposit.

14. The size of the container had little if any influence on the survival of eggs, larvae, or pupae.

15. In view of the above data, it would appear that for control during mild winters, special emphasis should be placed on the elimination of all small receptacles, since many possibly would have viable eggs adhering to their inner surfaces, and some of these eggs may remain dry or even wet for long periods and still hatch and develop into adults.

Acknowledgment

This investigation was undertaken at the suggestion of Dr. Asa C. Chandler, Special Consultant for the *Aedes aegypti* Division of the Office of Malaria Control in War Areas, and the author is grateful for his advice and counsel. The cooperation of the men of the *Aedes aegypti* project in Houston is also appreciated.

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PRECIPITIN TECHNIQUE FOR DETERMINING MOSQUITO BLOOD MEALS [1]

By E. H. Arnold, *Passed Assistant Engineer (R);* S. W. Simmons, *Sanitarian (R);* and Dorothy G. Fawcett, *Junior Assistant Sanitarian (R); United States Public Health Service*

The importance of a given species of *Anopheles* as a malaria vector depends largely upon its feeding habits, the important vectors throughout the world being those which feed most consistently on man. In any given locality, often only one species of *Anopheles* is primarily responsible for malaria transmission. By concentration of control efforts upon this species, a great deal of time, labor, and money may be saved. This procedure is commonly called "species sanitation."

To add more light to information concerning the malaria and potential malaria vectors in this country, and to determine whether there are seasonal, geographic, or species variations in host preferences, the feeding habits of our American *Anopheles* are being studied. This study involves use of the precipitin test to determine the source of the mosquito blood meal.

COLLECTION OF MOSQUITO SPECIMENS

The specimens are collected by local MCWA inspectors during the course of routine inspections, and are forwarded to the Henry R. Carter Memorial Laboratory of Savannah, Ga., for testing. The collectors are instructed to select only freshly engorged females, with swollen red abdomens, indicating that they have had recent blood meals. Specimens are collected in the morning to minimize digestive action on the blood, and are taken from a variety of natural and artificial resting places.

As soon as collected, each specimen is crushed on an individual filter paper, upon which is recorded data as to general locality, specific collection place, species of mosquito, distance from nearest continually

[1] From Malaria Control in War Areas (Henry R. Carter Memorial Laboratory), States Relations Division.

available source of human blood, whether such is screened or not, name of collector, and date. The specimens are then submitted to the laboratory by mail, on the day they are collected.

Figures 1 and 2 show data sheets on which the information sub-

ANOPHELES HOST PREFERENCE STUDIES

DAILY WORK SHEET

CARTER MEMORIAL LABORATORY — SAVANNAH, GEORGIA

STATE Georgia
AREA 4
DATE EXAMINED 7-18-45
BY D.G.F.

NUMBER	TOWN	DATE COLLECTED	COLLECTION PLACE	COLLECTOR	SPECIES	DIST OF SPEC FROM MAN YDS	RESULTS H	E	B	P	A	N	U	REMARKS
1	Example	8-30-45	Shed	J. Doe	A. quad.	20-3		+						
2	"	"	"	"	"	"			+					
3	"	"	"	"	"	"			+					
4	"	"	"	"	"	"	+							
5	"	"	"	"	"	"				+				
6	"	"	"	"	"	"			+					
7	"	"	"	"	"	"					+			
8	Grenora	9-3-45	Barn	Rabbit	A. crec.	40-0			+					
9	"	"	"	"	"	"			+					
10	"	"	"	"	"	"		+						
11	"	"	"	"	"	"			+					
12	"	"	"	"	"	"							+	gum. ins.
13	"	"	"	"	"	"				+				
14	"	"	"	"	"	"					+			
15	"	"	"	"	"	"			+					
16	"	"	"	"	"	"		+						weak
17	"	"	Privy	"	A. quad.	30-0	+							
18	"	"	"	"	"	"			+					
19	"	"	"	"	"	"			+					
20	"	"	"	"	"	"	+							
21	"	"	"	"	"	"		+						
22	"	"	"	"	"	"				+				
23	"	"	"	"	"	"			+					
24	"	"	"	"	"	"	+							

KEY
H - HUMAN P - PORCINE
E - EQUINE A - AVIAN
B - BOVINE N - NEGATIVE
U - UNSATISFACTORY

FIGURE 1.—*Anopheles* host preference studies. Daily work sheet.

ANOPHELES HOST PREFERENCE STUDIES

HOST AND HABITATION SUMMARY SHEET

CARTER MEMORIAL LABORATORY — SAVANNAH, GEORGIA

STATE Georgia
MONTH September
SPECIES A. quad.

PLACE OF COLLECTION		NUMBER OF SPECIMENS FEEDING ON HUMAN	EQUINE	BOVINE	PORCINE	AVIAN	NO REACTION
BARN		52	76	318	42	48	60
BARN-COW		3	10	112	18	11	13
BARN-HORSE							
BARN-MULE							
BRIDGE		3	4	12	1		1
CHICKEN-COOP		24	24	171	56	155	57
CULVERT				5		15	
FEED BINS							
GARAGE				1			
HOUSE		9	13	49	4	12	11
HOUSE-VACANT							
HOUSE-BASEMENT							
PIG STY							
PRIVY		30	46	272	74	23	43
MISCELLANEOUS SHELTERS		24	27	266	98	41	56
OUTDOOR GATHERING PLACES				14	2	1	2
TOTAL NUMBER OF SPECIMENS		145	200	1214	315	296	244
PERCENT OF TOTALS		6.00	8.28	50.30	13.05	12.26	10.11
A - SPECIMEN WITHIN 1 MILE OF SCREENED HABITATION	NUMBER	117	184	976	169	269	191
	PERCENT	6.24	8.21	52.02	9.01	14.34	10.18
B - SPECIMEN WITHIN 1 MILE OF UNSCREENED HABITATION	NUMBER	28	45	236	45	27	51
	PERCENT	6.48	10.42	89.63	10.42	6.25	11.80
C - DISTANCE OF SPECIMEN FROM HABITATION UNKNOWN	NUMBER		1	2	1		2
	PERCENT		16.67	33.33	16.67		33.33

FIGURE 2.—*Anopheles* host preference studies. Host and habitation summary sheet.

mitted with the specimen, and results, are recorded. The daily work sheet is used to record collection information and the blood meal determinations of the individual specimens as they are tested. The host and habitation summary sheets are the ones at present being used to summarize data by months for the particular regions concerned, in relation to the collection place.

To date a total of over 150,000 specimens have been tested including the following species: *A. quadrimaculatus*, *A. pseudopunctipennis*, *A. punctipennis*, *A. albimanus*, *A. crucians*, *A. freeborni*, and *A. punctulatus*.

THE PRECIPITIN TEST

The Rice and Barber [2] modification of the Uhlenhuth-Weidanz precipitin test was used. With this technique, 1 cc. of each animal antiserum is sufficient to run approximately 200 to 250 tests in duplicate, and one person is capable of running this number per day.

Preparation of antiserums.—Antiserums for man, horse, cow, hog, and chicken are used. The antiserums are prepared at the laboratory by injection of normal serum into rabbits, which receive intravenous injections totaling 3.7 cc.

Injections are given at 3-day intervals, and are as follows: 0.2 cc., 0.5 cc., 0.5 cc., 0.75 cc., 0.75 cc., and 1.0 cc. Each rabbit receives only four injection series, being allowed a rest period of from 3 to 4 weeks between bleedings and the beginning of a new injection series. The animal receives a desensitizing dose of 0.001 cc. blood serum diluted in a convenient quantity of saline, 2 or 3 days prior to beginning the last three injection series, which are as previously outlined. Eight to twelve days after the last injection of the series, approximately ½ cc. of blood is taken from the marginal ear vein of the rabbit and the titer determined. Only antiserum titering above 1:5,000 is used. At this time the remaining portion of the antiserum sample is diluted with a mixture consisting of one part glycerine to two parts normal saline, to produce final antiserum concentrations in the diluent of 1 plus 7, 1 plus 14, and 1 plus 28. This antiserum diluent mixture is checked against 1:500 dilutions of the antigen by means of capillary tube cards described below. In instances where the antiserum fails to meet requirements, boosting injections of normal serum may be given; the dosage depending upon the titer present.

The minimum requirement is an easily visible reaction at the interface of the antiserum and antigen, in the 1 plus 7 dilution. In many cases it will be possible to dilute the antiserum to 1 plus 14 or more. If the above requirements are met, the rabbit is bled from the heart, taking from 30 to 60 cc. depending upon the size of the animal. The

[2] Rice, J. B., and Barber, M. A.: Malaria studies in Greece. A modification of the Uhlenhuth-Weidanz precipitin test for determining the sources of blood meals in mosquitoes and other insects. J. Lab. and Clin. Med., 20:876-883 (1935).

blood is allowed to clot in centrifuge tubes; the clot is broken and centrifugated. The antiserum recovered is diluted with an equal volume of glycerine and stored in a refrigerator at approximately 40° F. until used.

In preparation for the test, one part of the 1:1 mixture of glycerine and antiserum is added to three parts of a diluent consisting of one part of glycerine in 6⅔ parts of normal saline. The diluted antiserum is checked previous to starting a day's run, by checking it against 1:100 and 1:500 dilutions of known normal serum. This is for ascertaining if the antiserum has maintained its potency, that no chance contamination has occurred, and that the test is producing clearly discernible reactions. Usually the antiserum produces an easily discernible reaction at the above dilutions, and in many cases it may be possible to dilute the antiserum further, as indicated by the controls.

No cross reactions have been observed with the antiserum as prepared. Tests for "group" reactions by checking various lots of antiserums against related animals have been made. These tests have been limited in scope, but the following is a list, first of the antiserum and then of bloods for which that antiserum has given a positive reaction with the test as performed: Horse, mule; cow, sheep, deer, goat; chicken, pigeon, duck, sparrow.

Preparation and testing of blood samples.—Specimens received from the field are held in the refrigerator until they are examined. Before testing the blood sample, the mosquito identification is checked, the data accompanying the specimen are recorded, and the blood spot is cut out of the piece of filter paper, and placed in the compartment of an especially constructed tray (fig. 3). The blood is extracted from the filter paper with physiological saline (2 to 3 cc.) and then is allowed to settle to insure obtaining a clear supernatant fluid for the test. The antigen (diluted stomach blood) is picked up by capillarity in five glass tubes (1.5 mm. inside diameter) cemented into a unit between glass slides and referred to as a card (fig. 3). The antigen rises in the tubes to a height of approximately 1½ cm. The unit is then touched to a pad of absorbent cotton, which is wet with physiological saline and overlaid with a blotter, which draws away from one-third to one-half of the antigen, and wipes the bottom of the tubes (fig. 4). The blotter and cotton are best placed in a large tray of approximately 12 x 12 inches. The cards should be touched first at the distal end of the tray and proceed successively toward the operator, so that no two sets of tubes are blotted in the same position, which will provide a safeguard against contamination. The antiserum is placed in small shell vials, five vials being mounted side by side, each containing a different antiserum, and each of the capillary tubes with one motion is brought into contact with a different anti-

serum (fig. 5). The antiserum flows into the capillary tube, bringing the total height of liquids in the tube to approximately the original level. The unit now has a layer of each animal antiserum under the one antigen, which consists of the diluted blood from one mosquito stomach. The reaction, consisting of a precipitate at the interface of the two liquids, often appears in the appropriate tube within a very few minutes.

Reading results.—After 30 minutes of incubation at room temperature, the reactions are read with the aid of a magnifying glass mounted in an illuminated reading box (fig. 6). The reaction appears in the form of a biconvex lens at the interface of the antigen and antiserums. It is necessary that the units of cards should not be agitated previous to reading, in order not to disturb the lens. A diffuse reaction might appear in the region of the interface rather than the narrow, sharp, easily recognized, positive one.

Precautions.—It is necessary, as with all precipitin work, to be careful and precise in performing the test. Care is particularly necessary with a technique such as this, since it is routine, and becomes tedious after some time has been spent at the work.

The cleaning of the cards of capillary tubes is very important. They are suspended in sulphuric-bichromate solution overnight, and are then shaken free of the solution, washed in water containing a wetting agent, and then thoroughly washed with tap water. Afterwards the cards are suspended in a large dish of distilled water, where they are left until used. It is essential that all of the acid be removed from the units, since its presence, even in small amounts, is likely to cause a nonspecific precipitation of the antiserum. The washing procedure used above is considered reliable. However, the units are randomly sampled, and tested with litmus paper before use, as a check on their cleanliness.

All tests should be made in duplicate, and all doubtful reactions discarded unless the material is particularly valuable. Specimens are submitted in abundance, so that here only clear, positive reactions are considered. The purpose of the feeding habit survey does not require the identification of meals which are scanty or otherwise inadequate.

The technique has been checked repeatedly by comparing results with those obtained when the same series is conducted in test tubes. The results of examination by the two methods agree very closely, the test tube method being perhaps a bit more sensitive, but requiring more time and materials.

The diluted antiserum in the row of glass vials is dipped until all is used. No evidence has been found to indicate that the test is impaired by this procedure or that contamination occurs. Touching the unit of tubes to the blotter removes any excess antigen before

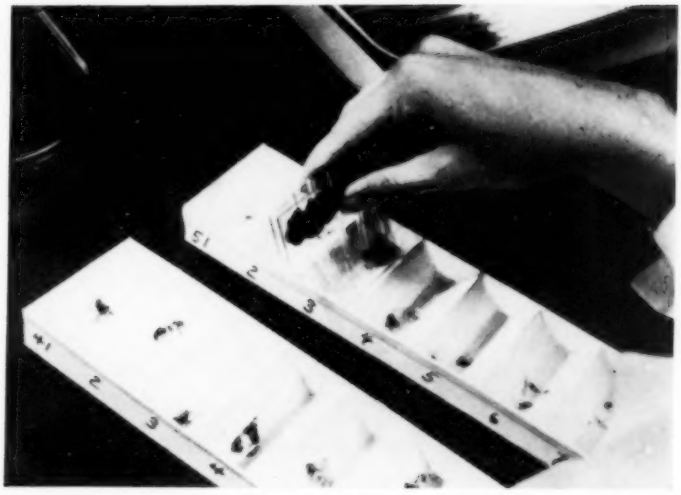

FIGURE 3.—Dipping capillary tubes into antigen, consisting of extract of mosquito blood meal.

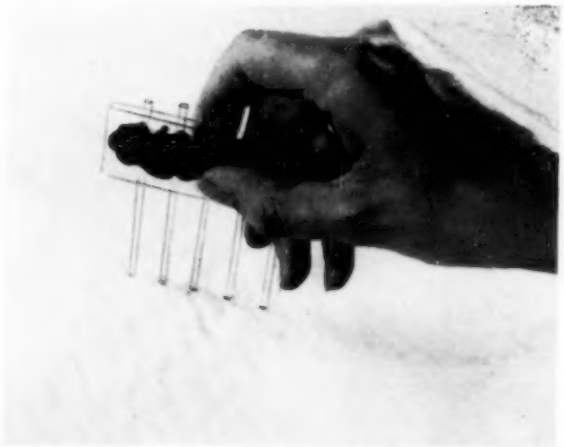

FIGURE 4.—Blotting capillary tubes containing antigen on cotton and filter paper wet with saline.

FIGURE 5.—Dipping card of capillary tubes simultaneously into vials containing human, equine, bovine, porcine, and avian antiserums, and placing them in incubation racks.

FIGURE 6.—Reading and recording results.

dipping. The flow of the precipitin serums into the tubes apparently prevents any mixture of antigen and antiserums in the vials, which are checked frequently for cloudiness.

DEATHS DURING WEEK ENDED JULY 27, 1946

[From the Weekly Mortality Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended July 27, 1946	Corresponding week, 1945
Data for 93 large cities of the United States:		
Total deaths	8,256	8,346
Average for 3 prior years	8,243	
Total deaths, first 30 weeks of year	281,522	276,166
Deaths under 1 year of age	670	623
Average for 3 prior years	640	
Deaths under 1 year of age, first 30 weeks of year	18,768	18,242
Data from industrial insurance companies:		
Policies in force	67,234,427	67,384,931
Number of death claims	11,437	12,304
Death claims per 1,000 policies in force, annual rate	8.9	9.5
Death claims per 1,000 policies, first 30 weeks of year, annual rate	10.0	10.7

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED AUGUST 3, 1946

Summary

A total of 1,284 cases of poliomyelitis was reported for the week, as compared with 911 last week and a 5-year (1941–45) median of 450. The largest number previously reported for a corresponding week was 1,029, reported for the week in 1931. Increases occurred in all geographic divisions except the South Atlantic and East South Central, but were largest in the East and West North Central areas. Of the 37 States reporting currently 5 or more cases, 18 showed increases of 5 or more cases, as follows (last week's figures in parentheses): Massachusetts 11 (4), New York 43 (30), New Jersey 14 (5), Ohio 44 (38), Illinois 117 (66), Michigan 46 (13), Wisconsin 30 (18), Minnesota 257 (188), Iowa 50 (17), Missouri 77 (38), North Dakota 31 (11), South Dakota 23 (5), Nebraska 38 (33), Kansas 80 (36), Virginia 12 (6), Arkansas 30 (18), Colorado 63 (48), California 60 (52). In States reporting currently 5 or more cases, decreases occurred in Pennsylvania (11 to 9), Georgia (16 to 8), Florida (20 to 17), Alabama (17 to 14), Mississippi (25 to 9), Oklahoma (33 to 28), Texas (52 to 43), and Oregon (9 to 5). The cumulative total is 5,455, as compared with 2,913 for the period last year, 3,992 in 1944, and a 5-year median of 2,766.

Of a total of 230 cases of diphtheria, as compared with 164 last week and a 5-year median of 169, Texas reported 29 (last week 15), California 20 (last week 18), New York 17 (last week 7), and Michigan 15 (last week 4).

Of 19 reported cases of infectious encephalitis, as compared with 15 last week, 14 occurred in California, and of 165 cases of typhoid and paratyphoid fever, as compared with 146 last week, Texas reported 31 (last week 7) and Virginia 14 (last week 4).

A total of 7,986 deaths was recorded for the week in 93 large cities of the United States, as compared with 8,266 last week, 8,152 and 8,140, respectively, for the corresponding weeks of 1945 and 1944, and a 3-year (1943–45) average of 8,191. The total for the year to date is 289,518, as compared with 284,318 for the same period last year.

Telegraphic morbidity reports from State health officers for the week ended Aug. 3, 1946, and comparison with corresponding week of 1945 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none was reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45
	Aug. 3, 1946	Aug. 4, 1945		Aug. 3, 1946	Aug. 4, 1945		Aug. 3, 1946	Aug. 4, 1945		Aug. 3, 1946	Aug. 4, 1945	
NEW ENGLAND												
Maine	2	0	0	------	------	------	30	1	27	0	0	0
New Hampshire	0	0	0	------	------	------	3	------	3	0	1	0
Vermont	0	0	0	------	------	------	71	9	17	0	0	0
Massachusetts	9	3	3	------	------	------	210	95	95	0	3	8
Rhode Island	1	0	1	------	------	------	11	------	10	1	2	1
Connecticut	1	0	0	------	------	1	85	8	18	0	1	1
MIDDLE ATLANTIC												
New York	17	8	6	[1] 1	------	------	387	36	176	6	17	17
New Jersey	4	1	1	2	------	2	104	31	49	2	6	6
Pennsylvania	8	2	6	------	1	------	150	94	57	6	4	4
EAST NORTH CENTRAL												
Ohio	4	8	4	------	------	3	167	15	46	2	5	2
Indiana	4	8	4	------	6	4	8	7	7	0	0	0
Illinois	7	2	7	------	7	4	48	89	50	6	3	3
Michigan [2]	15	8	3	------	------	------	107	29	57	2	5	5
Wisconsin	4	5	1	------	6	5	154	43	109	1	5	3
WEST NORTH CENTRAL												
Minnesota	4	2	2	------	------	------	20	2	9	2	0	0
Iowa	0	0	3	------	------	------	20	8	16	1	1	1
Missouri	1	2	3	------	------	------	12	17	17	0	4	4
North Dakota	0	3	1	20	------	------	1	------	3	1	0	0
South Dakota	1	0	1	------	------	------	1	6	6	1	0	0
Nebraska	0	2	1	3	------	------	1	2	2	1	2	0
Kansas	1	8	2	------	------	------	5	9	15	1	3	2
SOUTH ATLANTIC												
Delaware	0	0	0	------	------	------	------	1	1	1	0	0
Maryland [2]	6	7	3	------	------	1	64	2	31	0	2	4
District of Columbia	0	0	0	------	------	------	19	------	7	0	1	1
Virginia	11	4	7	99	30	35	51	7	11	1	2	2
West Virginia	1	12	2	------	20	------	9	------	9	1	1	1
North Carolina	9	18	9	------	------	------	24	2	11	2	2	2
South Carolina	4	8	4	72	57	70	22	10	17	0	1	2
Georgia	6	5	9	------	2	6	13	2	6	0	1	1
Florida	3	5	3	1	------	4	7	5	5	0	1	1
EAST SOUTH CENTRAL												
Kentucky	5	2	2	------	------	------	6	6	6	0	1	1
Tennessee	2	4	3	1	6	6	10	4	6	2	7	2
Alabama	2	7	7	17	31	9	11	------	7	1	2	2
Mississippi [2]	9	7	4	------	------	------	------	------	------	5	2	2
WEST SOUTH CENTRAL												
Arkansas	4	4	4	------	8	3	6	13	9	1	3	0
Louisiana	4	17	3	------	4	3	8	23	5	0	6	1
Oklahoma	5	2	2	10	12	7	21	3	4	0	4	1
Texas	29	47	25	233	360	190	109	52	54	2	10	5
MOUNTAIN												
Montana	0	1	1	------	5	3	10	2	2	0	0	0
Idaho	0	0	0	17	3	------	9	17	21	0	1	0
Wyoming	0	0	0	------	1	2	3	2	2	0	0	0
Colorado	9	4	4	3	9	9	6	4	13	0	0	0
New Mexico	0	6	1	1	1	------	3	3	4	0	0	0
Arizona	3	1	1	8	25	22	22	4	10	0	0	0
Utah [2]	0	0	0	1	------	------	20	78	22	0	0	0
Nevada	0	0	0	------	------	------	1	------	11	0	0	0
PACIFIC												
Washington	12	3	4	------	------	0	21	65	46	1	2	2
Oregon	3	4	2	------	1	1	34	15	18	0	2	1
California	20	28	11	------	5	20	135	234	164	7	10	10
Total	230	258	169	489	600	600	2,239	1,055	1,476	57	123	123
31 weeks	9,462	7,823	7,084	190,686	69,498	80,678	636,019	99,660	533,746	4,331	6,004	6,004

[1] New York City only.
[2] Period ended earlier than Saturday.

Telegraphic morbidity reports from State health officers for the week ended Aug. 3, 1946, and comparison with corresponding week of 1945 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever [3]		
	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45
	Aug. 3, 1946	Aug. 4, 1945		Aug. 3, 1946	Aug. 4, 1945		Aug. 3, 1946	Aug. 4, 1945		Aug. 3, 1946	Aug. 4, 1945	
NEW ENGLAND												
Maine	1	2	1	2	5	8	0	0	0	0	0	1
New Hampshire	12	1	0	2	1	1	0	0	0	0	0	0
Vermont	1	5	1	1	3	3	0	0	0	0	0	0
Massachusetts	11	15	5	42	40	53	0	0	0	11	1	4
Rhode Island	0	0	0	1	1	2	0	0	0	0	0	0
Connecticut	0	9	9	8	6	11	0	0	0	0	0	1
MIDDLE ATLANTIC												
New York	43	83	18	58	101	80	0	0	0	4	8	8
New Jersey	14	82	7	17	32	24	0	0	0	4	6	3
Pennsylvania	9	31	15	39	44	47	0	0	0	7	11	10
EAST NORTH CENTRAL												
Ohio	44	12	12	53	57	55	0	0	0	3	3	8
Indiana	11	5	5	9	18	11	0	0	0	3	1	1
Illinois	117	26	22	20	53	41	0	0	0	3	1	7
Michigan [3]	46	5	7	27	48	42	0	0	0	9	2	4
Wisconsin	30	3	3	30	30	37	0	0	0	0	1	1
WEST NORTH CENTRAL												
Minnesota	257	1	3	22	13	13	0	0	0	1	0	0
Iowa	50	5	1	6	13	13	0	0	0	0	0	1
Missouri	77	4	4	11	18	14	0	0	0	8	4	8
North Dakota	31	0	0	1	10	1	0	0	0	1	0	0
South Dakota	23	0	0	1	0	5	0	0	0	0	0	0
Nebraska	37	0	3	8	8	6	0	0	0	0	1	0
Kansas	80	5	5	4	15	10	0	0	0	1	0	4
SOUTH ATLANTIC												
Delaware	2	2	0	1	1	1	0	0	0	0	1	0
Maryland [3]	2	6	6	8	18	14	0	0	0	2	1	2
District of Columbia	2	3	0	2	7	4	0	0	0	0	0	0
Virginia	12	15	4	14	13	6	0	0	0	14	7	7
West Virginia	5	0	1	10	11	11	0	0	0	5	3	5
North Carolina	6	5	2	8	20	17	0	0	0	2	4	7
South Carolina	1	8	4	2	6	3	0	0	0	1	3	3
Georgia	8	5	5	5	5	10	0	0	0	4	10	10
Florida	17	1	1	0	2	2	0	0	0	8	1	2
EAST SOUTH CENTRAL												
Kentucky	3	0	8	6	16	12	0	0	0	8	20	14
Tennessee	10	23	13	10	17	16	0	0	0	4	11	7
Alabama	14	4	4	14	14	11	0	0	0	2	0	5
Mississippi [3]	9	1	2	102	7	3	0	0	0	4	3	13
WEST SOUTH CENTRAL												
Arkansas	30	2	2	0	2	2	0	1	0	2	5	5
Louisiana	20	4	4	2	18	5	0	0	0	2	21	9
Oklahoma	28	14	1	3	4	4	3	0	0	2	7	8
Texas	43	38	5	18	19	18	0	0	0	31	29	28
MOUNTAIN												
Montana	7	0	0	1	1	3	0	0	0	3	0	0
Idaho	3	0	0	8	5	1	0	0	0	4	4	0
Wyoming	6	0	0	0	1	2	0	0	0	1	0	0
Colorado	63	5	2	10	13	10	0	0	0	0	1	1
New Mexico	9	1	2	1	5	1	0	0	0	2	3	3
Arizona	9	0	1	3	1	2	0	0	0	1	0	1
Utah [3]	2	12	1	5	3	3	0	0	0	0	0	0
Nevada	1	0	0	0	0	0	0	0	0	0	0	0
PACIFIC												
Washington	13	12	5	7	11	11	0	0	0	0	2	2
Oregon	5	1	1	10	14	7	0	1	0	1	8	3
California	60	18	9	61	89	66	0	0	0	7	3	5
Total	1,284	474	450	673	839	744	3	2	2	165	186	232
31 weeks	5,455	2,913	2,766	85,740	133,004	96,206	273	261	600	2,241	2,485	2,926

[3] Period ended earlier than Saturday.

[4] Including paratyphoid fever reported separately, as follows: Massachusetts (*Salmonella* infection) 8; New York 1; New Jersey 1; West Virginia 1; Georgia 2; Florida 1; Kentucky 1; Louisiana 2; Texas 4; Oregon 1; California 1.

Telegraphic morbidity reports from State health officers for the week ended Aug. 3, 1946, and comparison with corresponding week of 1945 and 5-year median

Division and State	Whooping cough			Week ended August 3, 1946							
	Week ended—		Median 1941–45	Dysentery			Encephalitis, infectious	Rocky Mt. spotted fever	Tularemia	Typhus fever endemic	Undulant fever
	Aug. 3, 1946	Aug. 4, 1945		Amebic	Bacillary	Unspecified					
NEW ENGLAND											
Maine	18	75	19								1
New Hampshire	3		2								
Vermont	17	28	25								2
Massachusetts	171	141	141								2
Rhode Island	12	4	15								
Connecticut	27	13	45	3							5
MIDDLE ATLANTIC											
New York	159	356	249		2			3			8
New Jersey	186	237	149			1	1	2			1
Pennsylvania	121	233	229					1			1
EAST NORTH CENTRAL											
Ohio	116	280	260	1						1	1
Indiana	9	55	42								4
Illinois	188	118	164	5	1			6			9
Michigan [2]	77	74	177								5
Wisconsin	225	87	225								18
WEST NORTH CENTRAL											
Minnesota	12	10	53						1		
Iowa	46	10	32	3			1				16
Missouri	13	23	23					2	2		1
North Dakota	1		11								
South Dakota		1	3					1			
Nebraska	5		7				1				
Kansas	26	24	57				1				3
SOUTH ATLANTIC											
Delaware	2	1	1					4			
Maryland [2]	35	54	84			1		4	1		
District of Columbia	10	16	20					1			
Virginia	144	71	70	1		153		4	3		4
West Virginia	13	52	41					2			1
North Carolina	125	163	199		1			6	1	3	1
South Carolina	27	71	84		10					1	
Georgia	12	21	20		4		1	5		27	5
Florida	15	11	11							25	2
EAST SOUTH CENTRAL											
Kentucky	27	54	61					2			1
Tennessee	22	73	44			1		4	1	1	1
Alabama	278	18	22							7	6
Mississippi [2]									2	5	2
WEST SOUTH CENTRAL											
Arkansas	4	27	10		2				9		
Louisiana		39	5		2					8	2
Oklahoma	8	16	7	1				3			7
Texas	194	161	178	28	302	19			1	23	16
MOUNTAIN											
Montana	4	2	29					1			1
Idaho	13	6	6		1						2
Wyoming	1	5	6						2		
Colorado	9	49	49		1						1
New Mexico	3	6	6			6					
Arizona	5	10	14			17					
Utah [2]	8	33	33	1		2			1		
Nevada											
PACIFIC											
Washington	30	37	37								
Oregon	28	19	19								1
California	70	216	185	2	4		14			3	5
Total	2,519	3,000	3,413	45	330	200	19	51	24	104	135
Same week, 1945	3,000			47	648	751	14	47	13	173	103
Average, 1943–45	2,971			46	620	476	18	[4] 39	14	[4] 155	
31 weeks: 1946	60,231			1,738	10,699	4,141	338	353	595	1,880	3,012
1945	79,405			1,124	14,956	4,970	242	306	492	2,310	2,947
Average, 1943–45	87,919		[4]116,280	1,131	12,311	4,479	323	[4] 323	474	[4]1,923	

[2] Period ended earlier than Saturday.
[4] 5-year median, 1941–45.

WEEKLY REPORTS FROM CITIES

City reports for week ended July 27, 1946

This table lists the reports from 87 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
NEW ENGLAND												
Maine:												
Portland	0	0	------	0	10	0	3	0	0	0	0	5
New Hampshire:												
Concord	0	0	------	0	------	0	1	0	0	0	0	------
Vermont:												
Barre	0	0	------	0	------	0	0	0	0	0	0	------
Massachusetts:												
Boston	2	0	------	0	29	0	6	1	6	0	1	20
Fall River	0	0	------	0	7	0	0	0	2	0	0	3
Springfield	0	0	------	0	11	0	0	0	2	0	0	7
Worcester	0	0	------	0	18	0	6	0	2	0	0	24
Rhode Island:												
Providence	0	0	1	0	5	0	0	0	0	0	0	14
Connecticut:												
Bridgeport	0	0	------	0	1	0	3	0	0	0	0	------
Hartford	0	0	------	0	3	0	0	0	0	0	0	2
New Haven	0	0	1	0	3	0	0	0	0	0	0	------
MIDDLE ATLANTIC												
New York:												
Buffalo	0	0	------	0	2	1	0	0	1	0	0	------
New York	5	0	1	2	75	4	39	18	15	0	1	45
Rochester	2	0	------	0	4	1	1	2	3	0	0	------
Syracuse	0	0	------	0	------	0	1	3	4	0	0	1
New Jersey:												
Camden	0	0	------	0	------	0	1	0	0	0	1	1
Newark	0	0	------	0	5	0	3	0	3	0	0	41
Trenton	0	0	------	0	3	0	0	0	0	0	0	3
Pennsylvania:												
Philadelphia	1	0	2	0	12	1	7	0	7	0	3	19
Pittsburgh	0	0	------	0	16	1	3	0	0	0	0	6
Reading	0	0	------	0	------	0	1	0	0	0	0	------
EAST NORTH CENTRAL												
Ohio:												
Cincinnati	0	0	------	0	2	0	0	2	1	0	2	6
Cleveland	0	0	1	0	89	0	3	19	7	0	0	13
Columbus	0	0	------	0	2	0	2	0	4	0	0	6
Indiana:												
Fort Wayne	0	0	------	0	------	0	2	0	0	0	0	------
Indianapolis	0	0	------	0	1	0	3	5	0	0	0	6
South Bend	0	0	------	0	------	0	0	0	0	0	0	------
Terre Haute	0	0	------	0	------	0	1	0	0	0	0	------
Illinois:												
Chicago	0	1	------	0	19	1	17	26	4	0	0	96
Springfield	------	------	------	------	------	------	------	------	------	------	------	------
Michigan:												
Detroit	6	1	1	0	5	1	4	23	9	0	9	83
Flint	0	0	------	0	1	0	1	0	1	0	0	------
Grand Rapids	0	0	------	0	3	0	2	1	1	0	0	26
Wisconsin:												
Kenosha	0	0	------	0	8	0	0	2	0	0	0	------
Milwaukee	0	0	------	0	14	1	1	1	4	0	0	99
Racine	0	0	------	0	26	0	0	0	3	0	0	1
Superior	0	0	------	0	2	0	0	0	1	0	0	20
WEST NORTH CENTRAL												
Minnesota:												
Duluth	1	0	------	0	1	0	1	3	0	0	0	1
Minneapolis	1	0	------	0	10	0	5	84	1	0	0	------
St. Paul	0	0	------	0	8	0	1	32	2	0	0	10
Missouri:												
Kansas City	0	0	------	0	------	1	6	17	1	0	0	12
St. Joseph	0	0	------	0	------	0	0	0	0	0	0	3
St. Louis	1	1	------	0	3	0	9	13	1	0	0	6

City reports for week ended July 27, 1946—Continued

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
WEST NORTH CENTRAL—continued												
North Dakota:												
Fargo												
Nebraska:												
Omaha	0	0		0		0	4	10	2	0	0	3
Kansas:												
Topeka	0	0		0		0	2	6	0	0	0	6
Wichita	0	0		0	1	0	4	6	1	0	0	2
SOUTH ATLANTIC												
Delaware:												
Wilmington	1	0		0	1	0	0	1	1	0	1	3
Maryland:												
Baltimore	2	0		0	52	0	5	1	1	0	1	11
Cumberland	0	0		0	2	0	0	0	0	0	0	
Frederick	0	0		0		0	0	0	0	0	0	
District of Columbia:												
Washington	0	0		0	20	0	5	0	4	0	0	9
Virginia:												
Lynchburg												
Richmond	0	0		1	2	0	0	1	2	0	1	21
Roanoke	0	0		0		0	0	0	0	0	0	
West Virginia:												
Charleston	0			0	1	0	0	0	1	0	0	
Wheeling	0	0		0		0	0	0	1	0	0	9
North Carolina:												
Raleigh	0	0		0	3	0	2	0	0	0	0	5
Wilmington	1	0		0	3	0	1	0	1	0	0	
Winston-Salem	0	0		0	2	0	0	0	0	0	0	16
South Carolina:												
Charleston	0	0	3	0	1	0	2	0	0	0	0	
Georgia:												
Atlanta	0	0		0	1	0	4	2	1	0	0	
Brunswick	0	0		0		0	0	0	0	0	0	
Savannah	0	0		0	2	0	0	0	0	0	0	
Florida:												
Tampa	2	0		0		0	0	1	1	0	0	1
EAST SOUTH CENTRAL												
Tennessee:												
Memphis	2	0		1	1	0	4	4	1	0	0	2
Nashville	0	0		0		0	2	0	0	0	0	
Alabama:												
Birmingham	0	0		0		0	2	5	0	0	1	
Mobile	1	0	1	0		0	1	2	0	0	0	
WEST SOUTH CENTRAL												
Arkansas:												
Little Rock	0	0		0	1	0	0	5	0	0	0	
Louisiana:												
New Orleans	0	0		0	1	0	5	22	1	0	0	
Shreveport	0	0		0		0	3	2	0	0	0	
Texas:												
Dallas	1	0		0		0	0	1	1	0	0	6
Galveston	0	0		0		0	1	0	0	0	0	
Houston	1	0		0		0	9	1	1	0	0	1
San Antonio	0	0		0		0	0	0	0	0	1	
MOUNTAIN												
Montana:												
Billings	0	0		0	15	0	0	0	0	0	0	
Great Falls	0	0		0	6	0	0	0	1	0	0	
Helena	0	0		0		0	0	0	0	0	0	
Missoula	0	0		0	3	0	1	0	0	0	0	
Idaho:												
Boise	0	0		0		0	1	0	0	0	0	
Colorado:												
Denver	1	0		0	12	0	2	19	12	0	1	
Pueblo	0	0		0	7	0	0	2	0	0	0	
Utah:												
Salt Lake City	0	0		0	2	0	0	0	2	1	0	

City reports for week ended July 27, 1946—Continued

	Diphtheria cases	Encephalitis, infectious, cases	Influenza cases	Influenza deaths	Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
PACIFIC												
Washington:												
Seattle	0	0	------	0	2	0	5	4	0	0	1	15
Spokane	0	0	------	0	------	0	1	1	0	0	0	1
Tacoma	0	0	------	0	2	0	0	1	0	0	0	3
California:												
Los Angeles	4	0	2	1	39	2	5	16	10	0	0	11
Sacramento	0	1	------	0	------	1	2	2	2	0	0	------
San Francisco	1	0	------	0	7	0	2	0	7	0	1	------
Total	36	4	13	5	587	15	208	367	139	1	25	708
Corresponding week, 1945	55	------	10	3	506	------	239	------	220	0	19	1,026
Average, 1941–45	41	------	22	[1] 6	[2] 600	------	[1] 230	------	228	0	27	1,099

[1] 3-year average, 1943–45.
[2] 5-year median, 1941–45.

Dysentery, amebic.—Cases: New York 7; Indianapolis 1; Chicago 3; Richmond 1.
Dysentery, bacillary.—Cases: New York 3; Chicago 1; Winston-Salem 1; Charleston, S. C., 4; Nashville 1; Los Angeles 5.
Dysentery, unspecified.—Cases: Boston 1; San Antonio 10.
Rocky Mountain spotted fever.—Cases: New York 4; Richmond 1; Nashville 1.
Tularemia.—Cases: Memphis 1.
Typhus fever, endemic.—Cases: Atlanta 1; Tampa 3; Mobile 2; New Orleans 3; Shreveport 1; Houston 1; San Antonio 3; Los Angeles 1.

Rates (annual basis) per 100,000 population, by geographic groups, for the 87 cities in the preceding table (estimated population, 1943, 34,254,300)

	Diphtheria case rates	Encephalitis, infectious, case rates	Influenza case rates	Influenza death rates	Measles case rates	Meningitis, meningococcus, case rates	Pneumonia death rates	Poliomyelitis case rates	Scarlet fever case rates	Smallpox case rates	Typhoid and paratyphoid fever case rates	Whooping cough case rates
New England	5.2	0.0	5.2	0.0	227	0.0	49.7	2.6	31	0.0	2.6	196
Middle Atlantic	3.7	0.0	1.4	0.9	54	3.7	25.9	10.6	15	0.0	2.3	54
East North Central	3.7	1.2	1.2	0.0	105	1.8	22.1	48.4	21	0.0	6.7	218
West North Central	6.0	2.0	0.0	0.0	46	2.0	64.4	343.9	16	0.0	0.0	86
South Atlantic	9.9	0.0	5.0	1.7	149	0.0	31.4	9.9	22	0.0	5.0	124
East South Central	17.7	0.0	5.9	5.9	6	0.0	53.1	64.9	6	0.0	5.9	12
West South Central	5.7	0.0	0.0	0.0	6	0.0	51.7	89.0	9	0.0	2.9	20
Mountain	7.9	0.0	0.0	0.0	357	0.0	31.8	166.8	119	7.9	7.9	32
Pacific	7.9	1.6	3.2	1.6	79	4.7	23.7	38.0	30	0.0	3.2	47
Total	5.5	0.6	2.0	0.8	90	2.3	31.7	56.0	21	0.2	3.8	108

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended July 6, 1946.—During the week ended July 6, 1946, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		35		66	246	38	35	21	51	492
Diphtheria			2	17	7	3	1	1		31
Dysentery:										
Amebic					1					1
Bacillary				1						1
German measles				3	11	1		3	5	23
Influenza		1			2	2				5
Measles		32	2	184	309	93	21	237	23	901
Meningitis, meningococcus				1	1	1	1			4
Mumps				12	86	28	56	12	36	230
Poliomyelitis				4	1					5
Scarlet fever		13	2	41	33	13	2	9	10	123
Tuberculosis (all forms)		6	19	50	53	19	16	2	27	192
Typhoid and paratyphoid fever				15	2		2		3	22
Undulant fever		4		4	4	1			1	14
Venereal diseases:										
Gonorrhea		16	9	139	106	42	40	33	81	466
Syphilis		16	9	78	60	10	18	13	42	246
Other forms				2						2
Whooping cough		9		20	53	2	1	3	1	89

NORWAY

Notifiable diseases—February 1946.—During the month of February 1946,[1] cases of certain notifiable diseases were reported in Norway as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	19	Mumps	162
Diphtheria	291	Pneumonia (all forms)	3,385
Dysentery, unspecified	6	Poliomyelitis	26
Epidemic encephalitis	2	Rheumatic fever	220
Erysipelas	390	Scabies	5,087
Gastroenteritis	3,672	Scarlet fever	535
Gonorrhea	832	Syphilis	112
Hepatitis, epidemic	676	Tuberculosis (all forms)	409
Impetigo contagiosa	2,978	Typhoid fever	4
Influenza	10,773	Undulant fever	3
Lymphogranuloma inguinale	1	Weil's disease	5
Measles	1,967	Whooping cough	3,256

[1] For report for the month of March 1946, see PUBLIC HEALTH REPORTS of Aug. 2, 1946, p. 1170.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Except in cases of unusual incidence, only those places are included which had not previously reported any of the above-mentioned diseases, except yellow fever, during recent months. All reports of yellow fever are published currently.

A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

Burma.—For the week ended July 13, 1946, 264 cases of cholera were reported in Burma.

China.—Cholera has been reported in China as follows: Shanghai, July 11–20, 1946, 813 cases, 64 deaths; Kiangsu Province, June 21–30, 1946, 245 cases, 60 deaths; Kwangtung Province, June 21–30, 1946, 276 cases, 85 deaths, including 271 cases with 85 deaths reported in Canton.

Plague

China—Fukien Province.—Plague has been reported in Fukien Province, China, as follows: For the periods June 1–10, 1946, 247 cases, 104 deaths, including 131 cases with 48 deaths reported in Amoy; June 11–20, 1946, 130 cases, 59 deaths, including 29 cases with 17 deaths in Amoy; June 21–30, 1946, 48 cases, 28 deaths, including 41 cases with 24 deaths in Amoy.

Typhus Fever

Morocco (French).—For the period July 11–20, 1946, 55 cases of typhus fever were reported in French Morocco, by regions as follows: Agadir and frontier districts, 17; Casablanca, 22; Fez, 6; Marrakech, 2; Meknes, 5; Rabat, 3.

FEDERAL SECURITY AGENCY

United States Public Health Service

THOMAS PARRAN, *Surgeon General*

DIVISION OF PUBLIC HEALTH METHODS

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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